One of the primary reasons for an agency initiating such an internal update is its recent switch to a new life cycle methodology (LCM) and CASE tools. SIPS and the Departments of Public Instruction, Human Resources, and State Transportation have committed themselves to the full implementation of Andersen's Method/1 methodology and some, if not all, of the FOUNDATION CASE tools. The AOC has committed itself to the Knowledge Ware Application Development Workbench (ADW) CASE tools and the information engineering methodology. All other agencies were considering either developing or updating their home grown LCMs, and some were looking at other CASE tools (e.g., Excelerator from Intersolv).

The various agency IRM organizations are in many ways reinventing the same wheel at the same time. Furthermore, no agency appears to have dedicated adequate resources to accomplish the timely completion of these updated policies, procedures, and standards. Although some unique aspects of an agency's operation and mission will always exist, many agency IRM policies, procedures, and especially standards will be essentially the same.

Recommendation -- All agency IRM divisions should adopt a uniform set of technology policies, procedures, and standards.

- A Task Force from the IRM Office, SIPS, and the SIPS Advisory Board should be established to develop a uniform set of technology policies, procedures and standards. The Task Force should report to the IRMC.

- The Task Force would identify the required IRM policies, procedures, and standards that should apply at the agency level and develop a set of North Carolina State government IRM policies, procedures, and standards to serve as a basis for all agencies within the State. These policies, procedures, and standards should be developed in a modular fashion to be easily adapted to meet the needs of specific agencies.

- The IRMC should review the Task Force recommendations regarding which of the policies, procedures, and standards are subject to agency level modification, any limitations on such modification, and which need to be implemented without change as a statewide standard.

The model policies, procedures, and standards should address all appropriate topics and specifically address:

- One standard life cycle methodology and set of CASE tools to be used by all agencies. Considering that Andersen's Method/1 and FOUNDATION have already been paid for and adopted by three of the largest agencies and SIPS, and considering that no other agency (other than AOC) has yet made significant investment in any other LCM or CASE tool, the State should give serious consideration to standardizing on this methodology and tool set.

- A minimum set of project management standards to be applicable to every individually funded project, regardless of what State or third party resources are used to staff the project. These standards should specify the requirements for project planning, budgeting, scheduling, progress tracking, management reporting, and project quality assurance.

- Minimum design requirements for all new applications, including:

  System integration requirements for data sharing across applications to efficiently provide accurate, consistent, and timely data.

  Functionality standards that require designs focused on delivering the best service to the agency's clients and not simply on automating current manual tasks. The life span for most of these systems probably will be 15 or 20 years. They need to be state-of-the-art in design as well as in the underlying technology.

  Data center operations technical standards that provide for efficient and cost-effective use of all hardware and communications resources. SIPS provides whatever resources the agencies require. It is, therefore, the agencies' responsibility, under these technical guidelines, to make the most effective use of those resources.

  Copies of the established standards should be provided to the Purchase and Contracts Division for use in the competitive procurement process when applications software is being procured.

Finding 17 -- The agencies do not exercise effective quality assurance (QA) functions.

With few exceptions, the agencies do not give adequate management support and resources to the quality assurance function. For example:

- SIPS does not have a distinct quality assurance function within its organizational structure. Application development quality assurance is handled within the Application Development Division by one person. However, this person has been assigned to perform special studies instead of QA functions.

- The following agency IRM divisions have no formal QA function:

  Department of Environment, Health, and Natural Resources
  Department of State Treasurer
  Department of State Transportation

- Some major system modernization efforts have not produced the systems that were intended, e.g., Department of Revenue. Also, there appears to have been no assessment

of whether the systems that were successfully implemented have achieved the benefits originally expected.

A contributing factor to the lack of independent QA functions is that some of the smaller agency IRM divisions are too small to support one.

Recommendation -- Implement a statewide quality assurance program to assure the prudent management of major investments in information technology.

Three key components to this program are:

- The IRM Office should draft a policy for the IRMC's approval requiring that each large agency IRM division establish an independent QA function outside of the software development and maintenance function. The policy should further specify the minimum roles and responsibilities, and the related roles and responsibilities of the system development staff (e.g., walk-throughs, documentation, testing).

- The IRM Office should establish a centralized quality assurance function to support the smaller IRM divisions that cannot support independent QA functions of their own. The IRM QA function should work with the smaller agencies to establish quality as an integral part of each agency's software development process and to perform independent reviews of major software development efforts within the agency.

- For all major system development and modernization efforts that either exceed a specified dollar threshold or affect mission critical agency functions, the IRMC should establish an independent Major Automated Information System Review Committee (MAISRC) to conduct quality reviews at key milestones. The MAISRC would report to the IRMC on the status of the project effort and the technical feasibility of its successful completion.

Finding 18 -- SIPS and the IRM divisions in most cases have not provided adequate training and tools to technical staff.

Highly skilled and productive technical professionals are an essential but scarce resource among the agency IRM divisions and SIPS. Yet many of the State's information technology professionals have received inadequate training to stay abreast of state-of-the-art technologies, methodologies, and industry standards, and lack the tools necessary to do their jobs productively.

For the year ending June 30, 1991, the executive branch agencies spent less than $300,000 on technical training for more than 800 technical staff. On average, that is less than $375 per person per year. In terms of quality technical training, that level of expenditure would buy at most one to two days of training in a locally available program. It also strongly implies that many technical staff received no training at all last year. If this trend

continues, it will eventually cause the State's technical staff to lose technical currency and competency. It also will gradually cause the State to become increasingly dependent upon vendors for technical services, which is a costly alternative.

- For nearly twenty years, structured techniques have been a well accepted industry standard for developing high quality systems that are easily maintained. However, most State IRM staff have received little or no training in these techniques and do not regularly use them to design and implement systems. The following agencies need to strengthen their training and utilization of the disciplines of structured analysis, design, and programming:

  SIPS
  Department of Environment, Health, and Natural Resources
  Department of State Transportation
  Department of State Treasurer

- Many IRM divisions do not have a formal training program and do not track the current training levels and needs of their staff. A number of agency IRM divisions are planning to implement CASE tools as an integral part of the new system development process. But some, including SIPS, have not yet trained their staff to ensure that the new technology is properly introduced and implemented. It is widely accepted that a primary reason that CASE technology has failed at a number of organizations is the lack of skills in both CASE tools and basic structured development techniques.

- Most of the State's computer programmers still develop programs for mainframe applications using only the mainframe computer. The programmers "compile" and test their programs in batch mode instead of interactively. This is less productive for the programmers. There are four productivity tools available on the SIPS mainframe to facilitate the programmers' work, but they have limited present applicability across the agencies.

Recommendation -- All agencies should invest in an on-going program of appropriate training and tools for technical staff.

Each agency should allocate a small portion (approximately one percent) of its technology budget for training the technical staff. The training program should be built through two basic steps:

- The IRM Office in conjunction with the State Personnel Office should establish minimum training requirements for each IRM position. These minimum requirements should be incorporated into a policy statement and forwarded to the IRMC for approval.

- Each agency should develop a formal training program for its technical professionals to ensure that all staff in its organization receive the training required for their respective

positions. This training should be funded as part of each annual appropriation request. For major technology projects, special training requirements should be incorporated in the original appropriation request submitted.

All computer programming, both for agency IRM divisions and SIPS, should be moved off the mainframe to work stations (PCs) on the programmers' desks. The desktop is where the newest and best programmer productivity tools run. It is also a necessary programming environment for distributed client-server applications and for cooperative processing, both of which provide the end user with the benefits of an intelligent work station in place of the current dumb terminal. This approach has been instituted by SIPS and the Department of Human Resources; the Department of Public Instruction plans to do likewise once it moves into its new building.

Also, SIPS should acquire and provide training for some additional mainframe software productivity tools that have been common in industry for years and have broad applicability, such as:

COBOL code analyzers
Interactive debugging tools
Test data generators
Test coverage monitors

Finding 19 -- North Carolina does not have adequate disaster recovery capability for its data centers nor for its mission critical applications.

The State has a total of four IBM mainframe computers processing mission critical application systems. These are:

- SIPS, with an ES/9000-900
- Administrative Office of the Courts, with a 3090-300
- State Treasurer, with an ES/9000-135
- Department of Revenue, with a 4341 and 4381

Also, the General Assembly operates several DEC computers.

However, there is no adequate disaster recovery plan for any of these data centers.

SIPS does not have an operational disaster recovery plan. However, SIPS recently awarded a contract to IBM to provide a Hot Backup Recovery Site and disaster recovery plan for that site. The scope of the disaster recovery plan to be developed by IBM is to recover the SIPS data center operation at the IBM Tampa, Florida, back-up site, initially with half the

communications capacity. Full communications capability would be phased in over a period of two weeks.

The SIPS disaster recovery plan is expected to take six months to develop according to the current plan, and another six months to implement. This plan will not address disaster recovery of the Courts, Treasurer, or Revenue data centers. Application system disaster plans at the agency level will not begin until the initial phases of the SIPS plan have been completed (estimated to be six months from the time of this review) and will take at least another six months to prepare.

There is also no hot site back-up for any of the General Assembly's DEC computers.

Recommendation -- North Carolina should immediately reduce its exposure to prolonged disruption of its operations from potential data center disasters.

There are four specific steps that the State should take to reduce these risks:

- Expand the current SIPS Hot Site Contract with IBM to include the other three State IBM mainframe computer sites.

  With the exception of the check processing equipment used by the State Treasurer, the hot site for SIPS is large enough and adequately equipped to support the back up of the other IBM data centers without additional equipment. The probability of SIPS and one of these other sites requiring the hot site at the same time is extremely low. Also, many of these sites make heavy use of the SIPS State communication network that is going to be switchable to the recovery site. Much of the effort and cost associated with backing up these other State IBM sites will have already been addressed and operational as a result of the SIPS effort.

  The contract should require marginal change concerning the hot site itself (probably the inclusion of VM and VSE operating systems to run the Department of State Treasurer's VSE system). It will require some modification of the other IBM sites' hardware/software configurations to bring all sites into more consistent operations to simplify any potential recovery.

  These changes to the contract and to local site operations will provide all of the State's IBM data centers with hot site backup at a minimal cost increase over the current contract, and at significantly lower total cost than having individual hot site contracts for each of these data centers.

- The IRM Office, working with the four agencies with data processing centers, should develop guidelines for the development of data center level disaster recovery plans. This effort can be leveraged significantly on the work being performed by IBM for the

SIPS disaster recovery plan. It should be issued shortly after the IBM contract has finalized the outline of its plans.

- The SIPS application level disaster recovery planning guidelines should be updated with guidance concerning what the individual agencies should be doing today (e.g., setting application/program priorities or backing up documentation) versus what they have to postpone until the IBM prepared plan is finished. The agencies are generally waiting for the IBM plan under the misconception that they cannot initiate their own recovery planning until that point.

  The IRM Office should then support the agencies in developing detailed plans and schedules for the completion of the application level disaster recovery plans, and then monitor agency progress and provide assistance on request.

- The General Assembly should procure a hot site back-up contract to support its DEC data center operations.

Finding 20 -- Data security measures in effect among the agencies are generally not adequate to provide appropriate protection for sensitive data.

SIPS has installed IBM's Resource Access Control Facility (RACF) security package, Version 1.9, on the SIPS computer. It is SIPS' policy that the user agencies make the decision concerning the level of protection their systems and data files receive. However, the agencies' implementation of data security generally does not provide adequate protection for sensitive data, and their utilization of RACF does not even approach the current industry standard. For example:

- All application systems that run at SIPS are required, at a minimum, to use RACF for Level 1 security, which means that the user's access to SIPS must be via a system ID and password controlled by RACF. Any additional levels of security are left to the discretion of the individual agency IRM division. Though these measures alone are proper security actions, they fall far short of being adequate for truly sensitive information.

- Very few systems running at SIPS have transaction level security under RACF. Instead, most have transaction level security handled within the application system by CICS, the on-line monitor. However, IBM has removed this security capability from CICS as of version 3.2 because the industry standard is for the feature to reside in the security package. This means that to upgrade to CICS 3.2, an agency will have to convert its system from CICS to RACF.

- Few if any applications have data element protection, which is available through RACF.

Furthermore, the computer has become more in the public domain, and some 16 to 18 newspapers and interest groups have gained access to certain data in the SIPS computer.

The current philosophy within the State is that all information, unless otherwise specified, is in the public domain. The public can request access to any specific data files by requesting such access in writing. The request is reviewed for completeness, and a copy is sent to the agency that owns the data. Within that agency, the agency security administrator reviews the request and determines the level of access that will be permitted. When access is granted, the Controller of Security Administration will grant a password for access to the SIPS computer. It is the agency security administrator who must ensure that proper levels of control and access are granted to the requestor via RACF.

Recommendation -- Raise the statewide level of data security policies and procedures to protect the integrity and confidentiality of sensitive data.

Full implementation of effective data security will necessarily be a gradual process because there are so many application systems to be upgraded. However, there are several initial steps that should be taken:

- The IRM Office in conjunction with the SIPS Security Committee should develop specific data security policy for the agencies concerning the assessment and implementation of adequate security levels. The policy should require all data center and application security to go through an independent security package. This should include password control, transaction handling and logging, file access control, and data element control. Application system level security checks are to be granted only as an exception, and should require a waiver from the agency Security Administration Officer.

- SIPS should develop a viable migration plan and specific guidelines on what agencies need to do to convert their applications to RACF for all security functions.

- Each agency IRM division should develop a specific plan for migrating CICS transaction and application level security to RACF.

Additionally, the IRM office should publish guidelines for each agency to follow in reviewing its policies and data security requirements in light of public access to the SIPS computer. This is critical for the State given that information contained on State computers is considered public information unless otherwise classified and that access to State computers will become increasingly available to the public. Agencies need to reassess the level of access to be granted at both the file and data element level. Access to some select data may need to be restricted, while the rest of the data on the file may be unrestricted. The key restrictions on most data will be against data update to ensure data integrity.

Finding 21 -- State personnel policies and appointment practices impact the effectiveness of the IRM divisions.

Most agency IRM steering committees consist mainly of senior level appointed officials. This creates periodic difficulties, particularly when there is a change of administrations. The turnover in management reduces both the period during which the steering committee is effective and its level of effectiveness. Such turnover tends to change directions, juggle priorities, and shift consensus, all of which can be healthy for an agency but disastrous for a long term information technology project.

Regarding the effect of State personnel policies, several agency IRM managers have noted that many of the mid-level managers do not have the formal education appropriately required for their levels. Also, few staff members have college degrees in computer science or other related technical fields. For example:

- At Environment, Health and Natural Resources, the majority of technical personnel, including several individuals in key management positions, have high school educations.

- At Department of State Transportation, prior to the recent hiring to fill 43 new positions, over 90 percent of the staff in that IRM division had only high school diplomas.

It is certainly a credit to those individuals without advanced education in technology who have learned their skills on the job and have moved up to positions of greater responsibility. However, an IRM division also needs a material proportion of its staff to have advanced technical training and skills, most typically associated with college graduates, to deal successfully with the rapidly changing technology, the increasingly sophisticated tools and methodologies, and the complexities of large scale projects. Lacking such qualified staff, any IRM division will have difficulty keeping itself current and effective.

Recommendation -- The IRM Commission should sponsor executive briefings on technology.

The IRMC should establish a program of executive briefings on information technology for State management. The IRMC should:

- Directly sponsor periodic executive briefings for senior State management from all branches on management issues regarding information technology. These briefings should be planned and delivered by an expert consultant who is free of any conflicting business interests with the State.

- Direct the SIPS Advisory Board and the CIO to recommend and implement a structured program of executive briefings for agency management on agency and statewide technology initiatives.

The State's information technology activities will benefit from having its senior management better informed about technology and how it is most effectively used and managed. Notwithstanding the inevitable turnover in both elected and appointed officials in State government, this action can potentially help raise the level of management discussions about technology.

Recommendation -- The State should update technical position descriptions with appropriate current qualification requirements.

The IRM Office, in accordance with the State Personnel Office policies and procedures, should update the job descriptions for each IRM position to reflect minimum educational requirements and other appropriate technical qualifications. Consideration should be given to having all management positions require at least a bachelor's degree, and selected technical positions (e.g., Quality Assurance Coordinator and Technical Services Manager) require advanced college degrees in the fields of Computer Science or Telecommunications.

Telecommunications

Most agencies of North Carolina State government rely predominantly on State Telecommunications Services (STS) for telecommunications assistance. Thus, many of the statewide issues in telecommunications involve STS. Although STS is organizationally part of the State Information Processing Services, its issues are presented here instead of in the section on SIPS because most of them are broad and have potential impact far beyond the executive branch agencies of State government.

The performance audit identified STS and statewide telecommunications issues in the key areas of management, planning, and network management.

Finding 22 -- Management of telecommunications is not well organized across the agencies.

The State has centralized management responsibility for its voice and data communications network in STS. However, there is no corollary management structure among the agencies that use STS:

- Agencies generally do not have a specific unit responsible for telecommunications
- Data communication is generally the responsibility of the agency IRM manager
- Voice communication in many agencies is not the formal responsibility of any individual, or may belong to the IRM manager by default
- Few agencies have integrated the responsibilities for voice and data transport into a single function

- Numerous non-state-agency users (e.g., local governments using long distance service) have no structured management link with STS

There are also managers and users of other, major non-STS networks that are funded by the State that have no formal management connection back to STS

Recommendation -- The organization structure of telecommunications management should be formalized across the agencies.

The management structure needs to be formalized along two lines: at the agency level, and between the agencies and STS.

- Each agency should designate a Telecommunications Resource Management (TRM) manager to be responsible for providing agency level support for both voice and data communications to the user community and for interfacing with STS. The scope of the TRM function will vary according to the needs of each agency. The agency may decide to make its IRM manager responsible for the TRM function, or it may assign the responsibility to another individual.

- The SIPS Advisory Board should be expanded to include the TRM managers from the user agencies. Since many IRM managers are likely to serve in the TRM capacity as well, the size of the board should increase only moderately.

Exhibit 3-5 illustrates both aspects of the recommended management structure. The expanded SIPS Advisory Board should determine whether it will designate separate subcommittees to deal with State Computer Center issues and State Telecommunications Service issues. Other recommendations regarding the SIPS Advisory Board are included in other sections of this report and apply to the expanded board described above.

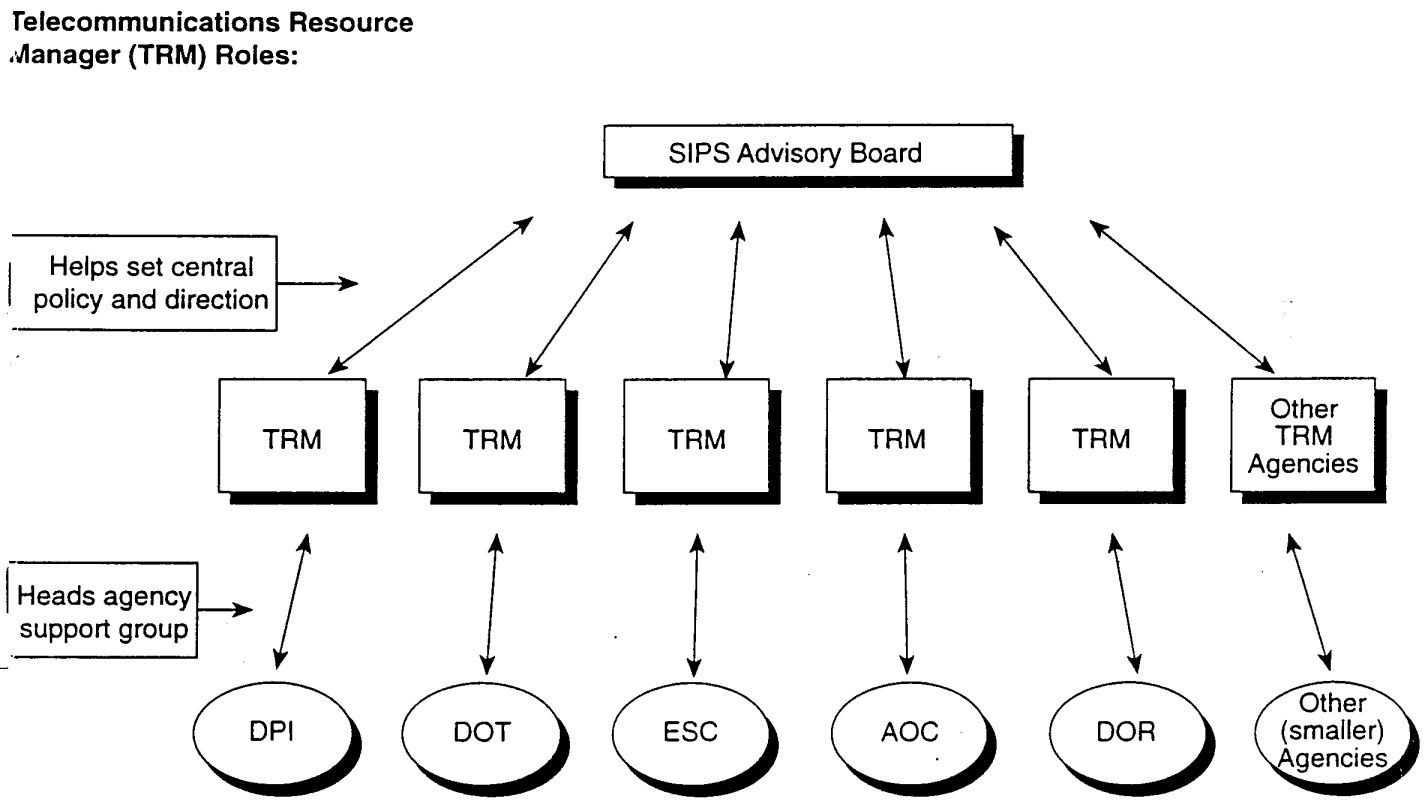
Recommendation -- The responsibilities for telecommunications management should be clearly assigned between STS and the agencies.

STS should adopt a flexible approach by agency to managing the necessary network support services, assigning responsibilities clearly to either the agencies or to itself. Because there are various components of the network to be managed, and varying levels of network requirements and network management expertise among the agencies, the responsibilities need to be well defined, agency by agency.

A clear breakdown of responsibilities can be based on a simple grouping of the seven different levels of telecommunication network components defined by the industry standard Open Systems Interconnection (OSI) Reference Model. Exhibit 3-6 illustrates this approach for structuring network management responsibilities.

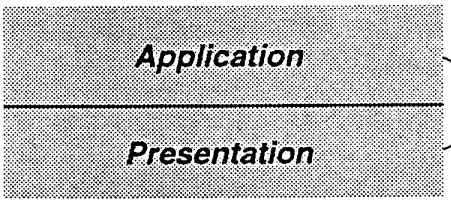
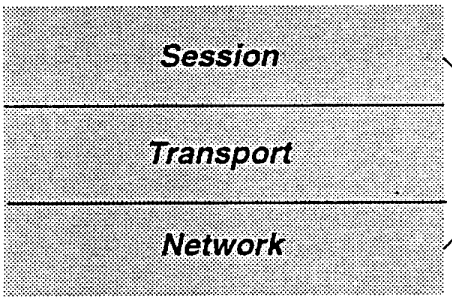
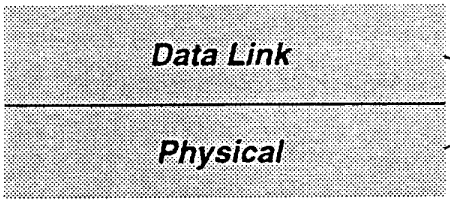
As illustrated, the seven components can be grouped in three areas of responsibilities.

Exhibit 3-5
Recommended Organization Structure for Telecommunications Management



Five Agencies Representing Majority of Support

Exhibit 3-6
Recommended Assignment of Network Management Responsibilities

OSI Levels of Network Components	Area of Responsibility	Responsible Entity
	End User/ Network Interface	Agencies
	Management of Shared Network Resources	STS or Agencies
	Physical Network Elements	STS

- End User/Network Interfaces
- Management of Shared Network Resources
- Physical Network Elements

The seven individual component levels can be described as follows:

- Application -- Word processors, data bases, E-Mail, video teleconferencing
- Presentation -- Network management systems, e.g., Netview, SNMP
- Session -- Resources accessed on a shared basis by one user, e.g., files, printers
- Transport -- Control of transmission content, e.g., message-switching protocols X.400 and X.500
- Network -- Network operating systems, e.g., Netware, LAN Manager
- Data Link -- Protocols for routing messages, e.g., X.25, EtherNet, Token Ring
- Physical -- Physical transmission media, e.g., optical fiber, twisted pair copper wires, microwave

The recommended approach to delegating these responsibilities is:

- STS should be responsible for managing the physical network elements, i.e., statewide backbone network or wide area network (WAN).
- The agencies should be responsible for managing the end user/network interfaces, i.e., the applications and network management products that affect the end users.
- Primary responsibility for management of shared network resources should be assigned to STS or to the agencies on an individual departmental basis, depending on the agency's requirements and capabilities. For agencies that are large enough and that are willing to hire and train telecommunications professionals, a shared management approach may be beneficial.

Finding 23-- STS has established closer relationships with its vendors than with its users.

STS has developed close relationships with the telecommunications vendors, in part through soliciting their technical advice and relying on it. This has benefitted the State because the

vendors tend to reciprocate STS' trust, providing timely response to State issues and offering the State greater access to the most current technical information.

However, agencies such as State Transportation, Public Instruction, Administrative Office of the Courts, and University of North Carolina, perceive that:

- The vendors have too much influence with STS
- The agencies have had insufficient opportunity to participate in and provide input to telecommunications plans
- The agencies have too little influence over their telecommunications destiny

Recommendation -- STS should balance its relationships between vendors and users in planning its technical services.

Regarding planning for its services, STS should increase the involvement of its users and their exposure to the vendors. Specifically, STS should:

- Request the telecommunications representatives on the SIPS Advisory Board to contribute to the telecommunications planning function, including key meetings with vendors, or to review and comment on the resulting plan.
- Take direct responsibility within STS for more aspects of the planning function, so that it relies less on the vendors, and then only for support. For example, STS' Network Operations and Engineering unit could assume responsibility for network recovery planning and for network modeling and optimization.

Such steps would:

- Keep telecommunications plans focused on identified and emerging users' needs
- Build user support for telecommunications plans through participation
- Balance STS' relationships with its vendors to maintain technical independence

Finding 24 -- SIPS' published plans for the State's telecommunications operation and information technology initiatives are insufficient.

STS' total operating expenses were approximately $23.5 million for the year ending June 30, 1991, of which some $13.5 million were direct costs for the operation of the North Carolina Integrated Network. STS' plan for telecommunications is presented in the Annual Information Processing Report and Plan for the 1990-1991 biennium, Section II. SIPS

Statewide Technology Assessment/Plans. It consists of about one and one-half pages of brief, broad statements of objectives, such as:

- "Video conferencing will be available and used by many agencies by the end of the next biennium with visual and sound quality acceptable to all participants."
- "Voice mail and electronic mail of text will be extensively expanded."
- "The use of facsimile (FAX) will continue to grow rapidly. It will become integrated with imaging systems of much greater functionality."

The objectives are laudable, but the plan provides no specifics and no details on scope, effort, time frame, or cost. Regardless of any technical planning that may have been done within STS, this is the only published documentation of the State's telecommunications plan, and it is clearly insufficient.

SIPS' internal planning involves the generation of a document called Major Initiatives. The Major Initiatives 1989/1990 document is just a list of the major initiatives or projects SIPS planned to address. There is no detail planning associated with these initiatives and no formal follow-up as to whether the initiatives were successfully completed. A number of the items identified in the 1989/1990 document have still not been fully implemented (e.g., disaster recovery plan or implementation of FOUNDATION). This document was not even produced for 1990/1991.

Recommendation -- STS should prepare an annual telecommunications plan in a rigorous, standardized format.

STS' annual plan should specify a series of initiatives with respect to statewide telecommunications issues. The plan should present a clear relationship with communications requirements based on agency programs and technology plans. Each STS initiative should be supported by a well-documented project statement that includes each of the following components, as appropriate:

- Goal or purpose
- Measurable objectives
- Description of the technology
- Anticipated benefits
- Planned completion date
- Quarterly project milestones for the first year

- Estimated annual budget for outside services and equipment
- Personnel requirements to support the effort
- Estimated annual operating costs
- Post-implementation audit plan, including specific evaluation criteria

Recommendation -- STS should prepare a strategic long range plan for State telecommunications.

North Carolina is beginning to outgrow the capacity of its statewide backbone telecommunications network, especially with regard to the growth of video applications. STS should prepare a strategic long range plan to determine the timing and transition milestones for its replacement.

The strategic planning effort should evaluate voice, data, and video requirements for all branches and departments of government. It should also consider key issues, such as:

- Agency plans and SIPS plans for centralized versus distributed delivery of information processing services
- Evolving new applications, e.g., video teleconferencing, imaging systems, voice messaging, electronic mail
- Pending consolidation of networks
- The State's overall strategy for service delivery to its citizens
- The State's approach to education, specifically, to distance learning
- Specific network vendor contracts and their expiration dates

The strategic plan should address:

- Anticipated voice, data, and video traffic by geographic distribution, with a timeline indicating when new applications will come onto the network
- Alternative network topology options, such as multidrop, star, point-to-point, virtual vis-a-vis dedicated, etc.
- Current versus anticipated utilization and geographic deployment of various computing platforms

Recommendation -- SIPS should enhance its information technology planning process.

SIPS should:

- Have each operational unit create a detailed plan for the accomplishment of each of its major initiatives, with a detailed work breakdown structure, major milestone dates, resource estimates, and criteria to measure progress and success.

- Broaden the performance assurance function to include SIPS planning. This function should coordinate the plans developed by each of SIPS' operational divisions and produce a SIPS plan to be submitted to the IRM Office for review and approval.

Finding 25 -- North Carolina's telecommunications needs are poised for rapid growth.

Currently, STS estimates that 80 percent to 90 percent of the State's network traffic is voice, and the rest is data. Rapid growth in demand for telecommunications capacity will result from an explosion of available video and image applications, which could account for 50 percent or more of the network capacity in the future. These applications include:

- Statewide implementation of distance learning

- Other growth in video teleconferencing

- Geographic Information Systems (GIS) and the need to transmit maps

- Highway Patrol's interest in transmitting photographic images of suspects

- Imaging system applications and the need to transmit images

Recommendation -- STS should proceed with its current planning for band-width on demand.

STS must start planning now for the replacement and/or expansion of the current network with a new one that is flexible enough to serve the bulk of the State's needs over a ten-year period. The most cost-effective strategy is likely to be for a network that can be modified and expanded, as opposed to one that would have to be replaced again to increase capacity. A well-developed and well-implemented plan could ultimately save the State $10 million to $20 million.

STS had previously begun planning for a "band-width on demand" network. This is an advantageous approach because it can provide the desired flexibility and can also reduce the State's long term capital investment and operating cost of the network. STS should give high priority to proceeding with this plan. It should also give careful consideration to its

term contracts for the current network to minimize termination costs as the State evolves to the new network.

Most networks have a fixed capacity or band-width. Since video applications require very high band-width, a network has to have high band-width to support video traffic, even if it is only occasional. The cost of a fixed network increases with greater band-width, regardless of how much of that capacity is actually used. Therefore, video networks are relatively expensive.

Band-width on demand means that the capacity of the network varies automatically to accommodate the level of traffic at any given time. This is a desirable characteristic for providing periodic support for video. The cost also varies with the band-width being used at any time. With this type of network, the State would pay only for the total amount of information transmitted over the network, but not for any unused capacity.

Finding 26 -- Several video pilot projects will create additional network costs for the State.

North Carolina currently has three pilot projects under way on two-way video teleconferencing. These pilots are for distance learning and remote medical diagnosis. They are each being funded by a non-state grant. For example, Southern Bell is funding the Vision Carolina distance learning pilot at University of North Carolina-Wilmington. The funding pays for all of the costs, including the network.

When the grants expire, the State will have to fund the networks if the pilot projects are to be continued. The continuation of these projects would likely cost the State hundreds of thousands of dollars per year. Furthermore, the networks, as implemented for the pilots, may or may not be cost-effective.

Recommendation -- The State should begin to determine whether it will support these pilot projects after the grants expire.

The State should independently assess each of the pilot projects to determine whether or not the project should be continued after its grant expires. If a pilot warrants continuation, the State should obtain an extension of the grant or secure alternative funding. In addition, the State should determine the degree to which the pilot will be expanded or replicated, as well as its impact on the current and/or emerging new State network.

All of these steps are time consuming. It is important to begin the process early to avoid disrupting a program at the end of its grant period.